

Dec. 1, 1953

O. M. KOSKINEN

2,660,957

ROTOR WHEEL

Filed March 16, 1949

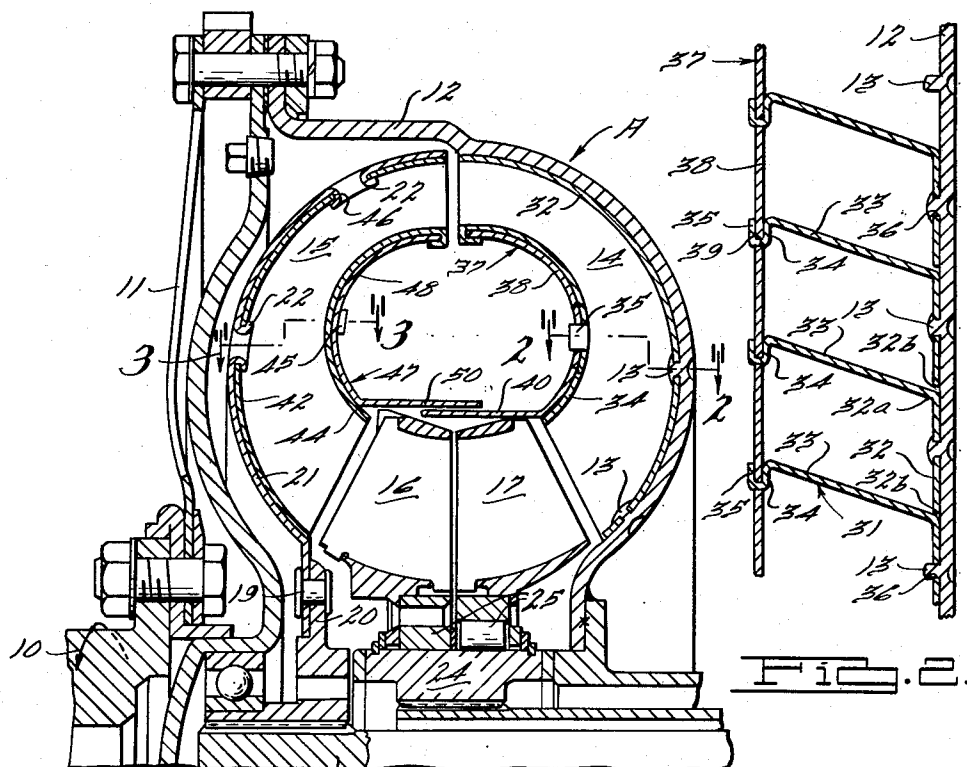


FIG. 1.

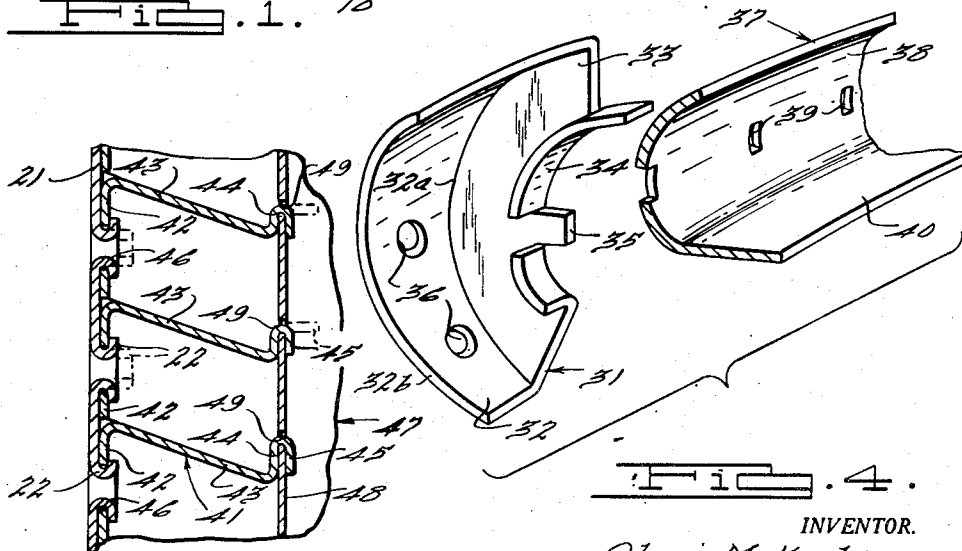


FIG. 3.

FIG. 4.

INVENTOR.
Olavi M. Koskinen.
BY George W. Tallent
for
Harness and Harris
ATTORNEYS.

UNITED STATES PATENT OFFICE

2,660,957

ROTOR WHEEL

Olavi M. Koskinen, Birmingham, Mich., assignor
to Chrysler Corporation, Highland Park, Mich.,
a corporation of Delaware

Application March 16, 1949, Serial No. 81,790

2 Claims. (Cl. 103—115)

1

This invention relates to bladed rotor wheels in general and is specifically concerned with bladed impeller and turbine wheels which form a basic part of hydraulic torque transmitting devices.

The bladed rotor wheels of hydraulic torque transmitting devices have heretofore been constructed chiefly by casting the blade elements and their supporting shroud and web structures as integral units or by casting the blade elements separately and then mounting the blade elements in either separately cast or stamped supporting shroud and web members. Both of these methods of manufacturing bladed rotor wheels are tedious and expensive, and, due to the casting processes frequently producing warped or pitted or rough surfaced products of variable porosity, the resultant rotor wheels frequently produce undesirable vibrations or they may leak or cause undesirable turbulence in the fluid passed through the cell-shaped channels in the wheels. Accordingly, a method of economically producing an improved type of bladed rotor wheel by stamping rather than casting has been developed and is herein disclosed.

It is a primary object of this invention to provide a fluid operated rotor wheel in which the blade elements as well as the blade element supporting members are formed from relatively simple stampings which may be easily and economically manufactured and assembled to provide a rotor wheel of superior quality at a reduced cost.

It is another object of this invention to provide a fluid operated rotor wheel having stamped blade elements which are so formed that upon assembly they interfit with adjacent blade elements and with preformed projections on their supporting members so as to mutually support each other and thus reinforce and rigidify the resulting wheel assembly.

It is a further object of this invention to provide a fluid rotor wheel formed from stamped shell and blade elements wherein the shells have integrally formed blade element supporting formations that interfit with mating integrally formed formations on the associated blade elements so that the supporting shell members provide an assembly fixture for the blade elements and also provide the means for connecting the blades to the supporting shell members. This construction eliminates the usually required assembly fixture for positioning the blade elements within their supporting shell member and materially simplifies the assembly of the rotor wheel.

This invention also eliminates the use of separate rivet or welded blade mounting means in the

2

assembly of the blade elements and consequently reduces costs and labor materially.

It is an additional object of this invention to provide a fluid rotor wheel formed from stamped blade elements arranged within a supporting shell wherein the blade elements have integral formations on their flange portions adapted to coact with the integral mating formations on the supporting shell members to insure proper spacing of the blade elements within the supporting shell.

It is a further object of this invention to provide a rotor wheel formed from stamped blade elements connected directly to a stamped exterior casing member in a manner which eliminates the need for an intermediate supporting shell member. As a result of the elimination of the intermediate supporting shell and separate blade connecting means, as well as several pinching and pressing steps, the method of manufacture of a rotor wheel has been simplified and the cost of production of such a wheel materially reduced.

It is still a further object of this invention to provide an improved method of manufacture of rotor wheels.

The above and other objects, advantages and novel features of this invention will be apparent from the following description when read in connection with the accompanying drawings wherein:

Fig. 1 is a sectional view of a hydraulic torque converter having bladed impeller and turbine wheels embodying this invention;

Fig. 2 is a fragmentary sectional elevation through the impeller wheel of the torque converter shown in Fig. 1, the view being taken along the line 2—2 of Fig. 1;

Fig. 3 is a fragmentary sectional elevation through the turbine wheel of the torque converter herein disclosed, the view being taken along the line 3—3 of Fig. 1; and

Fig. 4 is a perspective view of one of the blade elements and a portion of the torus ring used to fabricate the impeller and turbine wheels of the torque converter herein disclosed.

Fig. 1 shows a portion of a hydraulic torque converter unit A wherein a driving shaft 10 is connected by a flexible drive plate 11 to the torque converter casing 12 within which are mounted the bladed rotor wheels 14, 15, 16 and 17. Wheel 14 is the driving or impeller wheel and it is drivingly connected to the torque converter casing 12 so that it will be rotated by the driving shaft 10. Wheel 15 is the driven or turbine wheel which is adapted to be driven by the impelled fluid that is circulated within the con-

3

verter casing 12 due to rotation of driving shaft 10. Turbine wheel 15 is drivingly mounted on the forward end portion of a driven shaft 18 by means of a riveted connection 19 between the driven shaft flange 20 and the turbine wheel shell 21. Mounted concentrically about the driven shaft 18, and extending axially within the converter casing 12, is a fixedly mounted sleeve 24 which is adapted to rotatably support the guide or reaction wheels 16 and 17. The guide wheels 16 and 17 are connected to the fixed sleeve 24 through separate one-way roller brakes 25 which permit only forward rotation of the wheels 16 and 17, that is, in the normal direction of rotation of the shaft 10 and the driving wheel 14, and prevent reverse rotation of the wheels 16 and 17 in a direction opposite to that of the shaft 10 and wheel 14. The manner of operation of this hydraulic torque converter unit is thought to be obvious and as the operation of the converter forms no part of this invention a detailed description thereof will be omitted.

It has been customary practice in the past to cast the converter impeller and turbine wheels 14 and 15 but this method of manufacture has been expensive, time consuming, and tedious, and the resulting wheels have not always been of the highest quality due to inherent defects associated with the casting processes. In rotor wheel constructions where stamped blade elements and stamped supporting shell members have been used it has been conventional assembly practice to first provide the dish-like blade supporting shell and then mount a set of the blade elements in a fixture or jig after which the fixture or jig is positioned within the dish-like supporting shell so as to locate the blade elements in their desired positions. The next step consisted of fixedly connecting the blade elements to the supporting shell member and this was usually accomplished by riveting, welding or connecting interengaged, mating, tab and slot connectors formed on the blade elements and shell respectively. It is obvious that some form of jig or fixture would be required during these assembly steps to retain the blade elements in their desired positions prior to their connection to the supporting shell member. This invention eliminates the use of an assembly jig or fixture and certain other conventional parts of a rotor wheel and provides an improved, simplified, rotor wheel which is completely formed from stamped elements that may be easily, accurately, and economically assembled to provide a rotor wheel of superior quality.

The impeller wheel 14 is composed of the relatively thick, ring-like, outer, supporting shell member 12 which has a dish-like cross sectional configuration. On the inner surface of the semi-toroidal shell member 12 are mounted a plurality of substantially U-shaped blade or vane elements 31.

The blade elements 31 (see Figs. 2 and 4) are preferably stamped elements of substantially U-shaped cross sectional configuration and each blade element includes a relatively wide base flange portion 32, a relatively wide transversely extending blade or web portion 33, and a relatively narrow inner flange portion 34 spaced from the base flange portion 32 and extending in a substantially parallel direction with respect thereto. It will be noted that the spaced flange portions 32 and 34 are curved about axes extending normal to the blade portion 33 so as to provide inner and outer curved flange portions for the blade portion 33.

4

The base flange portion 32 of each blade element 31 extends transversely to the blade portion 33 and is shaped to conform to the inner surface contour of the shell member 12. This flange portion 32 is adapted to be connected to the inner surface of shell 12 by means of the riveted connecting means 36, 13 formed integrally on the blade element base flange 32 and the inner surface of the shell member 12 respectively. Base flange 32 is formed with one or more apertures 36 each of which is adapted to receive a stud rivet or the like 13. The relatively thick outer shell member 12 of the converter unit A is formed with the integral male rivet member 13 projecting from the inner surface thereof. Rivet members 13 are formed during the stamping of the converter shell member 12 and consequently involve practically no increase in cost of fabrication of the shell member 12. As the shell 12 is formed from relatively thick material there is more than enough material available to form the solid rivet members 13 without weakening the shell member 12 in any way. As a result of the integral formation of the rivets 13 it will be noted that the outer shell 12 is not pierced by openings of any sort that would require sealing to make the shell leak-proof. By forming the rivet members 13 on the inner surface of the shell 12 it is possible to eliminate completely the conventional outer shroud member for the impeller which shroud member is usually positioned adjacent the inner surface of the shell 12 and connected thereto by welding, brazing or the like. The conventional shroud member for an impeller wheel is of relatively thin stock and usually has the blade elements secured thereto by welding, brazing or by separate riveted connections. During assembly of the blade elements on the shroud member a jig or fixture is required to locate the blades on the shroud member and to hold the blades in assembled position while they are being connected to the shroud member. By the construction herein disclosed it is possible to eliminate the various jigs or fixtures for assembling the blades on the impeller wheel and to also completely eliminate the conventional impeller wheel shroud member. The converter shell 12 with the integral, inwardly projecting rivets 13 provides both the assembly jig and the means for mounting the blade elements on the shell member. Obviously less labor and material is required in fabricating an impeller wheel of the type herein disclosed than one which requires a separate shroud member and separate blade fastening means.

The blade portion 33 of each blade element 31 is substantially normal to the base flange portion 32 and extends outwardly from one side edge 32a thereof. The blade portion 33 is preferably curved about axes normal to the base flange portion 32 but the blade portion 33 could be a perfectly flat surface if so desired.

The other flange portion 34 of each blade element 31 extends transversely of the blade portion 33 and is disposed so as to extend from the same side of the blade portion 33 as that mounting the base flange portion 32 and to project substantially parallel to flange portion 32. Flange portion 34 includes the struck out tab formation 35 which is adapted to provide a mounting means for the inner torus ring web member 37.

The inner torus ring member 37 comprises a ring-shaped, dish-like main body portion 38 and a baffle flange portion 40 projecting from one edge of the body portion 38. Body portion 38 is formed

with spaced slots 39 adapted to receive the tabs 35 that project from the inner flange 34 of the blade elements 31.

In assembling an impeller wheel of the type herein disclosed the ring-like blade supporting shell member 12 is used as an assembly fixture and then a plurality of the substantially U-shaped blade elements 31 are concentrically mounted on the inner surface of shell 12 with the integral rivets 13 seated in the apertures 36 of the blade element base flanges 32. Next the blade elements 31 are fixedly connecting to the shell 12 by deforming the free ends of the rivet studs 13 to provide head portions that clinch the blade elements to the shell member. With this arrangement it will be noted that separate fixtures for mounting the blades 31 in the casing shell 12 are dispensed with and shell 12 and blades 31 carry preformed, integral stud and slot positioning formations that may be readily interengaged during assembly of the rotor wheel. No separate rivets or welding or brazing material need be handled to securely fasten the blade elements 31 to the shell member 12 for the integral mating formations 13, 36 provide both positioning means for locating the blade elements on the shell member and fastening means to anchor the blade elements to the shell member. Accordingly, the mounting of the blade elements on this impeller wheel is quite simple and economical from a manufacturing standpoint. After connecting the blade elements 31 to the inner surface of the shell 12 the torus ring 37 is mounted on the inner flanges 34 of the blade elements 31 with the blade tabs 35 projecting through the slots 39 in the body portion 38 of the torus ring. The next step in assembly of the impeller wheel is to crimp the blade tabs 35 about the torus ring body portion 38 so as to lock the torus ring in assembled position on the blade elements. Fig. 2 shows the crimped connection between the tabs 35 and slotted portions 39 of the torus ring body portion 38. It will be noted that the flange 34 of the blade element 31 provides a shoulder formation against which the torus ring 37 seats when it is locked in assembled position. This tends to rigidify the wheel assembly.

The turbine wheel 15 (see Figs. 1 and 3) is fabricated in a manner similar to that described for impeller wheel 14. In the case of the turbine wheel however the blade elements 41, which are practically identical to the blade elements 31 of the impeller wheel, are mounted on a blade encircling shell member 21 that is formed from relatively thin material as compared to the relatively thick material used for outer casing shell 12. The rivet members 22, stamped out of the thin shell 21 during fabrication thereof, are of the hollow type, but this does not create a sealing problem, as would be the case if hollow rivets were used on the impeller wheel, for the impeller wheel 15 rotates within the fluid filled, leak-proof outer shell 12 and fluid is present on both sides of the turbine wheel 15. The hollow rivets 22 provide seating studs on which to mount the apertures 46 in the base flanges 42 of the blade elements 41 during assembly of the blade elements on the shell 21. The shell 21 serves as an assembly fixture, as was the case with shell 12 of the impeller wheel. The blade portions 43 of blade elements 41 include inner flange portions 44 which are formed with the tab members 45 adapted to be mounted in preformed slotted formations 49 in the body portions 48 of torus ring member 47. Torus ring member 47 has a

baffle flange portion 50 similar to the flange portion 40 of torus ring 37. Assembly of the turbine wheel 15 is identical in method to that described for the impeller wheel 14. After mounting the blade elements 41 on the shell 21 and clinching the hollow rivets 22 to the blade element base portions 42 then the torus ring 47 is mounted on the blade element inner flanges 44 with the tabs 45 projecting through the slots 49 in the torus ring body portion 48. Final step in the assembly of the turbine wheel 15 is the crimping of the tabs 49 about the torus ring body portion 48 to anchor the torus ring to the blade elements. The several advantages noted with regard to the impeller wheel 14 are likewise inherent in the turbine wheel herein disclosed. It is considered within the scope of this invention to form any of the wheels of a hydraulic torque transmitting device in accordance with either of the constructions herein disclosed.

The blade elements 31 are so shaped that the base flange portions 32 accurately fit the contour of the inner surface of the shell 12 and extend circumferentially along this surface a distance approximately equal to the desired spacing of the blade elements. The free end 32b of each blade element base portion 32 practically abut against the end edge 32a of the base flange portion 32 of an adjacent blade element and this arrangement assists in accurately spacing the blade elements within the shell 12 and during assembly of the blade elements on the shell 12.

By this invention an improved type of rotor wheel can be completely formed from a minimum of stamped elements with a minimum of skilled labor and the accurate assembly of the blade elements is assured due to the interlocking connections between the blade elements and supporting shell members. In addition the impeller wheel construction disclosed eliminates at least one of the conventional shroud elements from an impeller wheel assembly due to the provision for mounting the blade elements directly on the outer shell unit. At the same time the completely stamped construction assures smooth, accurately formed, blade surfaces that will create a minimum of turbulence and that will have a maximum life. As the outer shell members 12 and 21 serve as fixtures for the assembly of the blade elements the rotor wheels may be assembled in a minimum of time by the simplest processes and with unskilled labor.

The guide wheels 16 and 17, and their method of manufacture, are described in the copending application of Olavi M. Koskinen, Serial No. 72,668, filed January 25, 1949, now Patent No. 2,632,396.

I claim:

1. A bladed wheel comprising a semi-toroidally shaped, imperforate, supporting casing having a plurality of integrally formed studs pressed out of and projecting from the inner surface of the casing, a plurality of blade elements mounted on the inner surface of said casing, and a blade connecting torus ring concentrically arranged within said casing and mounted on said blade elements, each blade element being of substantially U-shaped cross sectional configuration and comprising a pair of spaced flanges and a connecting web, the flanges extending transversely to the web of each blade at opposite edges thereof and being curved about axes normal to the web, one flange of each blade element being formed to provide a torus ring receiving shoulder portion and including a projecting tab engage-

able with the torus ring, and the other flange of each blade element being so shaped that it conforms to and may be supported on the casing inner surface, said other flange having openings therethrough that receive and are connected to the casing studs, the said other flanges being of such size and shape as to extend circumferentially along said inner surface of the casing and engage the web of an adjacent blade element to accurately space the blade elements about the supporting casing member.

2. A bladed rotor wheel for a hydraulic torque transmitting device comprising a stamped, semi-toroidally shaped, outer casing member having a plurality of integrally formed stud members pressed out of and projecting from the inner surface thereof, a plurality of stamped blade elements of U-shaped cross sectional configuration assembled in annular formation within the casing and mounted on the studs on the inner surface of the casing member, and a torus ring member arranged concentrically within said casing member and supported by said blade elements, each blade element comprising spaced flange portions connected by a transversely extending, normally disposed, web-like blade portion, one of the flange portions on each blade element being shaped to conform to the inner surface of the casing member having openings there-through receiving in mating, interengaged, rela-

tionship certain of the stud members on said casing member, the other flange portion of each blade element being shaped to conform to a surface of the torus ring and including integrally formed connecting tab means engageable with mating connecting slot means on said torus ring member to support said torus ring in spaced relationship to said casing member, said casing member with its integral studs providing an assembly fixture to facilitate the accurate mounting of the blade elements and the torus ring member within the casing member.

OLAVI M. KOSKINEN.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,167,950	Wilcox	Jan. 11, 1916
1,252,289	Murray	Jan. 1, 1918
1,689,244	Klimek	Oct. 30, 1928
1,868,146	Kiep	July 19, 1932
1,890,226	Mathis	Dec. 6, 1932
2,336,231	Dodge	Dec. 7, 1943
2,428,134	Zeidler	Sept. 30, 1947
2,431,648	Mayne	Nov. 25, 1947

FOREIGN PATENTS

Number	Country	Date
590,720	Great Britain	July 25, 1947